

The Neutral Source for the Exosphere of Ganymede from Sputtering and Sublimation Processes Combined

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The model presented here is a look at processes near the surface of Ganymede which lead to the formation of the exosphere. The magnitude of the neutral atmosphere source from both sublimation and sputtering has been calculated as a function of latitude, longitude, and local hour angle. The sublimation model is a surface-thermal model; an integration of a 1-D heat conduction equation, subject to a surface boundary condition, over the entire surface, for a diurnal cycle. Diurnal variation of sputtering was calculated using a function for volatile production from sputtering which is dependent upon the surface temperature of the substrate, after Bar-Nun, et al., [1985]. Results from the model have been used to construct a flux map of the near surface vapor on a $10^\circ \times 10^\circ$ scale.

A statistical study of the trajectories and energies of molecules released from the surface, after Butler [1998], has been conducted. A code for the migration of molecules across the surface has been adapted to Ganymede. Molecules are released from the surface, recombine with the surface after one hop, and are re-released if relevant conditions are satisfied. Results indicate that a single molecule makes a number of hops, (on the order of 100 hops), before finally coming to rest in a stable configuration in a cold trap. The length of time which released molecules spend in the atmosphere is on the order of hours. About 20% of the water vapor that is released from the surface will be dissociated.

The model has been extended to Callisto. Preliminary results will be presented.